Method and device in connection with winding of a paper or board web, in particular a tissue paper web

The invention relates to a method in connection with winding of a paper or board web, in particular a tissue paper web, at a slitter-winder, in which method the web is wound into a web roll/web rolls around a core/cores on support of winding drums, in which method a winding shaft is passed inside the core/cores for the duration of winding.

The invention also relates to a device in connection with winding of a paper or board web, in particular a tissue paper web, at a slitter-winder, which device comprises a winding shaft to be pushed inside a core/cores, around which core/cores the web is wound into a web roll/web rolls, and winding drums for supporting the core/cores and the web roll/web rolls being formed around the core/cores.

As known in the prior art, winding with a shaft together with cores is employed in the winding of a tissue web on a slitter-winder and after the winding a finished roll is pushed out of the machine onto a separate lowering cradle, on which the winding shaft is removed from inside the core by means of shaft pulling means. After that, the rolls are guided onwards and new cores are placed on said cradle for winding the next rolls manually and/or automatically. After the placement of the cores, a winding shaft if pushed inside them and by means of separate lever arms the winding shaft with its cores is moved to a storage station in the vicinity of the winding drums. When a new roll has been finished again and transferred onto said cradle, the winding shaft with its cores located in the storage station is moved between the winding drums and locked at its ends by means of separate shaft locking devices for the next winding operation. This kind of shaft handling device with its many actuators used in winding makes the winding complicated

and may thus cause problems in winding. In addition, the equipment unit is expensive and takes a lot of space.

In this description, by the core is meant one or more adjacent cores which are placed on the same winding shaft and by the web roll is meant one or more web rolls formed around a core/cores on support of winding drums, although said terms are partly used in this description only in the singular or in the plural.

An object of the present invention is to provide a method and a device by which it would be possible to eliminate or at least substantially reduce the problems and drawbacks described above.

With a view to achieving the above-mentioned objects as well as those coming out later, the method according to the invention is mainly characterized in that, in the method,

(a) an empty core / empty cores is/are placed on support of winding drums,
(b) a winding shaft is brought to the ready position in order for it to moved inside the core/cores,
(c) the winding shaft is pushed inside the core/cores,
(d) when winding makes progress, the winding shaft is moved in the direction of growth of a web roll/web rolls,
(e) when the web roll has been finished, the winding shaft is removed from inside the core/cores,
(f) a new winding operation is started and a winding core/winding cores is/are placed on support of the winding drums.

The device according to the invention is, in turn, mainly characterized in that the device comprises means for pushing a winding shaft inside a core/cores to start winding and to remove the winding shaft from inside the core/cores after the winding has been completed, and means for moving the winding shaft in the direction of growth of a web roll/web rolls when the winding makes progress.

In accordance with the present invention, when the web roll has been completed, the shaft is removed from the core of the web roll before the finished web roll is moved away from the winding drums onto a separate cradle, i.e. before it is pushed onto a lowering device or a tipping device.

When applying the method and the device in accordance with the invention, winding becomes simpler because the winding shaft need not be carried by means of complex arms from outside the machine between the winding drums.

Because of an advantageous additional feature of the method and the device in accordance with the invention, several metres of space is also saved in the longitudinal direction of the machine since a separate web cut-off device is not needed.

Standard components, such as a pushing device, core handling, a lowering device and a frame, can be advantageously used in connection with the device in accordance with the invention.

In addition, the device construction becomes simpler in connection with the invention because only one winding shaft is needed now.

By means of the invention, the space required by the drives of the winding drums is also made efficient use of. Moreover, the invention enables the use of shafts of different sizes, winding without cores and centre drive. Shafts of different sizes can be used as the level of the pushing-in position can be set correctly according to the diameter of the shaft with respect to the drums. In addition, for example, a lifting device must be reserved for changing the shaft. Winding without cores operates in the same way as winding with cores.The shaft is just pushed onto the drums on which there are no cores.

Centre drive can be placed in a pulling sledge of a fixed end. The drive is used for rotating the shaft, thereby affecting the properties of the roll that is being formed. The increased weight caused by the centre drive is compensated for by relieving the shaft.

In the following, the invention will be described in greater detail with reference to one of its preferred exemplifying embodiments with reference to the figures of the accompanying drawings.

Figures 1A-1F are schematic front views of one application of the device in accordance with the invention, by means of which views the different phases of the method in accordance with the invention are described.

Figures 2A-2C are schematic side views of one application of the device in accordance with the invention, by means of which views the phases of the method in accordance with the invention are described.

Fig. 1A is schematic view of the starting phase of winding. Empty cores 5 have been passed onto support of winding drums 6, 7 and a winding shaft 3 is in the ready position, i.e. in the position for insertion into the core. A fixed end of the winding shaft 3 is fixed to a pulling sledge 2 of the shaft, which sledge moves on a guide 1 in the figure in a vertical direction. The pulling sledge 2 and the guide 1 on the side of the fixed end of the winding shaft 3 are arranged to be movable in the figure in the horizontal direction in order that the winding shaft 3 may be passed to the winding position inside the cores 5 and, after the completion of winding, pulled out therefrom. The free end of the winding shaft 3 is supported by a support member 15. The winding shaft 3 is pushed to its position in the direction indicated by the arrow S in the figure in the horizontal direction such that the free end of the winding shaft 3 is attached to a second pulling sledge 8, which moves on second guides 9, which are vertical in the figure.

Fig. 1B shows the phase in which winding has been started and the winding shaft 3 is in the winding position. The winding shaft 3 has been pushed through the cores 5 such that its free end is attached to the second shaft pulling sledge 8 moving on the guides 9. The shaft pulling sledges 2, 8 move in the direction indicated by the arrows SY upwards on the guides 1, 9 when the winding makes progress and web rolls 4 are being formed around the cores 5.

Fig. 1C shows the phase in which the winding is about halfway through and the winding shaft 3 has moved further upwards in the direction indicated by the arrows SY while the pulling sledges 2, 8 have moved on the guides 1, 9 in a corresponding manner.

In the phase shown in Fig. 1D, the winding operation has been completed, the web rolls 4 have been finished around the cores 5, and the winding is stopped.

In the phase shown in Fig. 1E, after the winding operation has been completed, the winding shaft 3 is pulled away from inside the cores 5 in the direction shown by the arrow S in the figure in the horizontal direction. The free end of the winding shaft 3 is supported by the support member 15 when it has come out from inside the cores 5.

In the situation shown in Fig. 1F, preparations are made for the next winding operation, and the winding shaft 3 is lowered in the direction indicated by the arrow SA back to the starting level, after which new cores (not shown) are moved to the machine, after which a new winding operation starts from the phase shown in Fig. 1A. When the winding shaft 3 is moved downwards, the second shaft pulling sledge 8 is also moved on the guides 9 in the direction indicated by the arrow SA in the figure downwards to the starting level.

With reference to Figs. 2A, 2B and 2C, the operation and the method steps of the device according to one application of the invention at a tissue paper slitter are

described in the following. When a web roll 4 has been completed, a winding shaft 3 is pulled out from inside a core 5 or several successive cores 5 and placed in the pushing-in position, from which the winding shaft 3 is pushed inside a new core 5 or new cores 5. After pulling the winding shaft 3 out, the web roll 4 is pushed by a pushing device 14 onto a lowering device or lowering cradle 10. A new core 5 or new cores 5 are placed between winding drums 6, 7 by means of a core positioning device 13 provided in the pushing device 14. The web 12 is pressed by the core positioning device 13 against one winding drum or the winding drums 6, 7, whereby the web 12 is locked so as to be unmovable and, when it becomes tensioned, it breaks against a tip 101 of the downwards moving lowering device or lowering cradle 10. After the web 12 has broken, the pushing device 14 returns to its home position. When the cores 5 are positioned between the winding drums 6, 7, a backing spindle (not shown) is driven against one end of the core 5, which is preferably on the tending side of the slitter. The purpose of the backing spindle is to prevent the cores from escaping during threading of the winding shaft 3. The winding shaft 3, which has been placed in the pushing-in position, is pushed advantageously from the driving side through the cores 5 and locked at its free end by a separate shaft locking device, by means of which the winding shaft 3 is also relieved, if needed. After that, the backing spindle is driven to its home position and the web 12 is blown over the cores 5, after which winding can start again. In wide machines, the winding shaft 3 can be additionally supported by a support wheel, which moves on support of linear guides mounted on the frame, for example, by the action of a hydraulic cylinder.

In the device in accordance with the invention, the winding shaft 3 is an integrally functional part of the structure of the slitter. The winding shaft 3 has been mounted by means of bearings at its fixed end to the shaft pulling sledge 2, which moves according to the growth of the diameter of the web roll vertically on support of the linear guides provided for the shaft pulling sledge 2 on the centre line of the winding drums 6, 7. The second shaft pulling sledge 8 moves on support of the second guides 9 arranged on a foundation. The winding shaft 3 is

relieved, when needed, by a relief means, for example, a hydraulic cylinder (not shown) acting on the shaft pulling sledge 2. The free end of the winding shaft 3 is attached to the second pulling sledge 8. The free end of the winding shaft 3 is supported by the support member 15, when it is not in the winding position inside the cores 5.

As shown in Figs. 2A, 2B and 2C, one application of the device according to the invention comprises a winding shaft 3 to be pulled out from inside a core 5 of a finished tissue paper web roll 4 and pushed inside an empty core 5 on which the tissue paper web 12 is wound, which winding shaft is integrally and functionally a part of the slitter of the tissue paper web:

- winding drums 6, 7 supporting the wound web roll 4,
- a pushing device 14 by which the finished web roll 4, after the winding shaft 3 has been pulled out from inside the core/cores 5, is pushed away from the pulling-out position of the winding shaft 3 onto a lowering device or lowering cradle 10 of the web roll 4,
- a locking device 11 for the core/cores 5 for locking the core/cores 5 against the winding drums 6, 7, preferably the locking device 11 is formed by at least one suction cup beam extending parallel to the axis of the web roll 4, and
- a positioning device 13 for the core/cores 5, by means of which device the core/cores 5 can be placed in the pushing-in position of the winding shaft 3 between the winding drums 6, 7 and which presses the tissue paper web 12 so that it is unmovable against the winding drum 7, preferably the positioning device 13 is a profile or pressing element which extends parallel to the axis of the web roll 4 and which is pivotably attached to the pushing device 14 by means of a bearing journal and loadable at least against the winding drum 7 by means of a loading means (not shown in the figures), for example, a hydraulic cylinder.

Above, the invention has been described only by way of example by means of some of its preferred application examples. This is, of course, not meant to limit the present invention in any way and, thus, many alternative arrangements and

variations are feasible within the scope of protection of the inventive idea as defined in the appended claims.